



CMIP *Coupled Model Intercomparison Project*
WCRP World Climate Research Programme

PHASE 5

CMIP5 Overview

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Ron Stouffer and V. Balaji (GFDL), Bryan Lawrence (BADC)

Presentation at the
2009 **G**lobal **O**rganization for **E**arth **S**ystem **S**cience **P**ortal (**GO-ESSP**) Workshop Agenda

Hamburg, Germany

October 7, 2009



Preview

- CMIP5 experiments
- CMIP5: What's done? What needs to be done?
 - Website
 - Forcing
 - Variable list
 - CMOR and model output metadata
 - Defined vocabulary for defining CMIP5 output
 - Model and simulation documentation
 - ESG and CMIP5 archive
- Terms of use for CMIP5 data
- CMIP5 participating groups and timeline

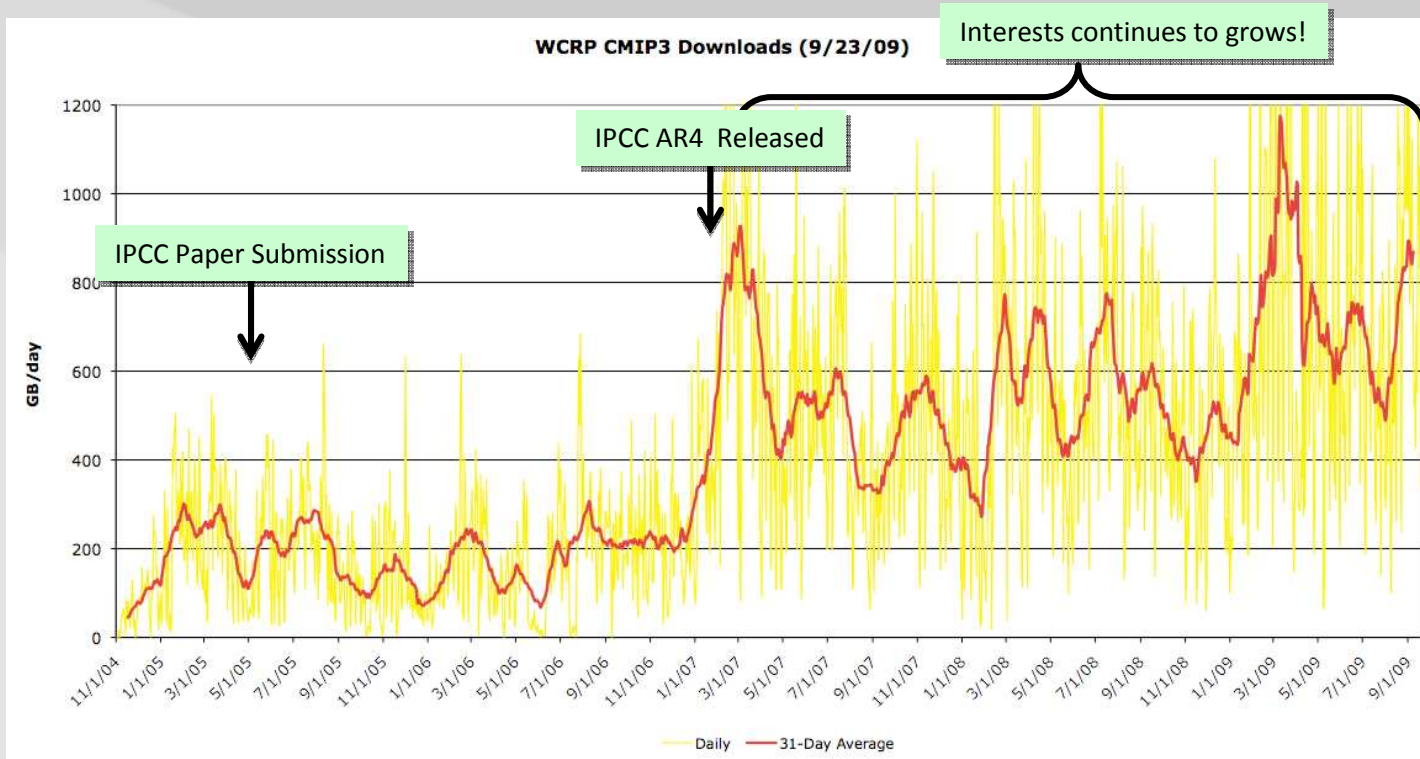


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Interest in CMIP5

- CMIP5 promises to be of exceptional interest: demand for CMIP3 results has increased since the AR4

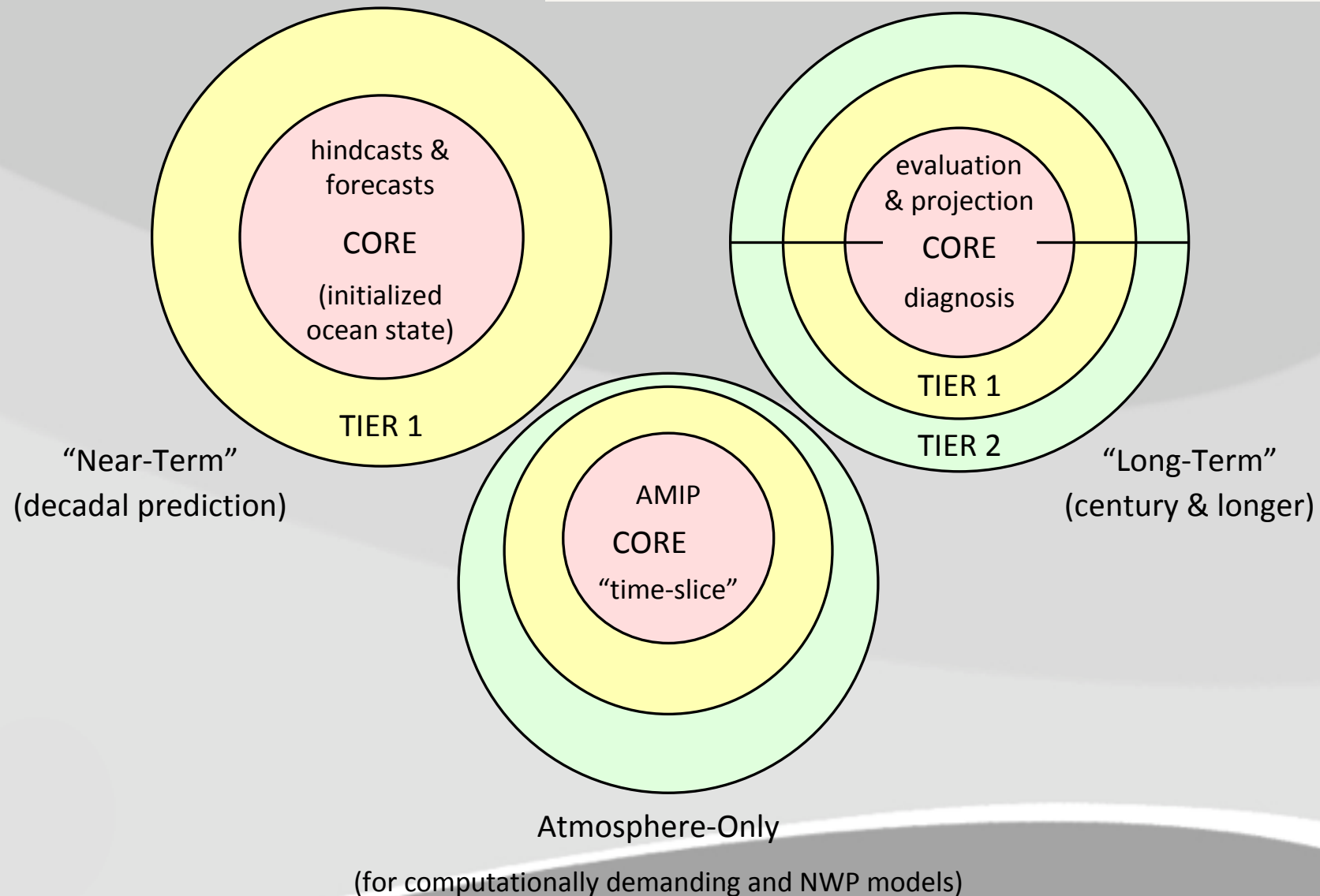


Courtesy of Bob Drach

- More than 540 publications
- More than 800 TB downloaded
- More than 3,000 users



CMIP5 “Three Suites” of experiments

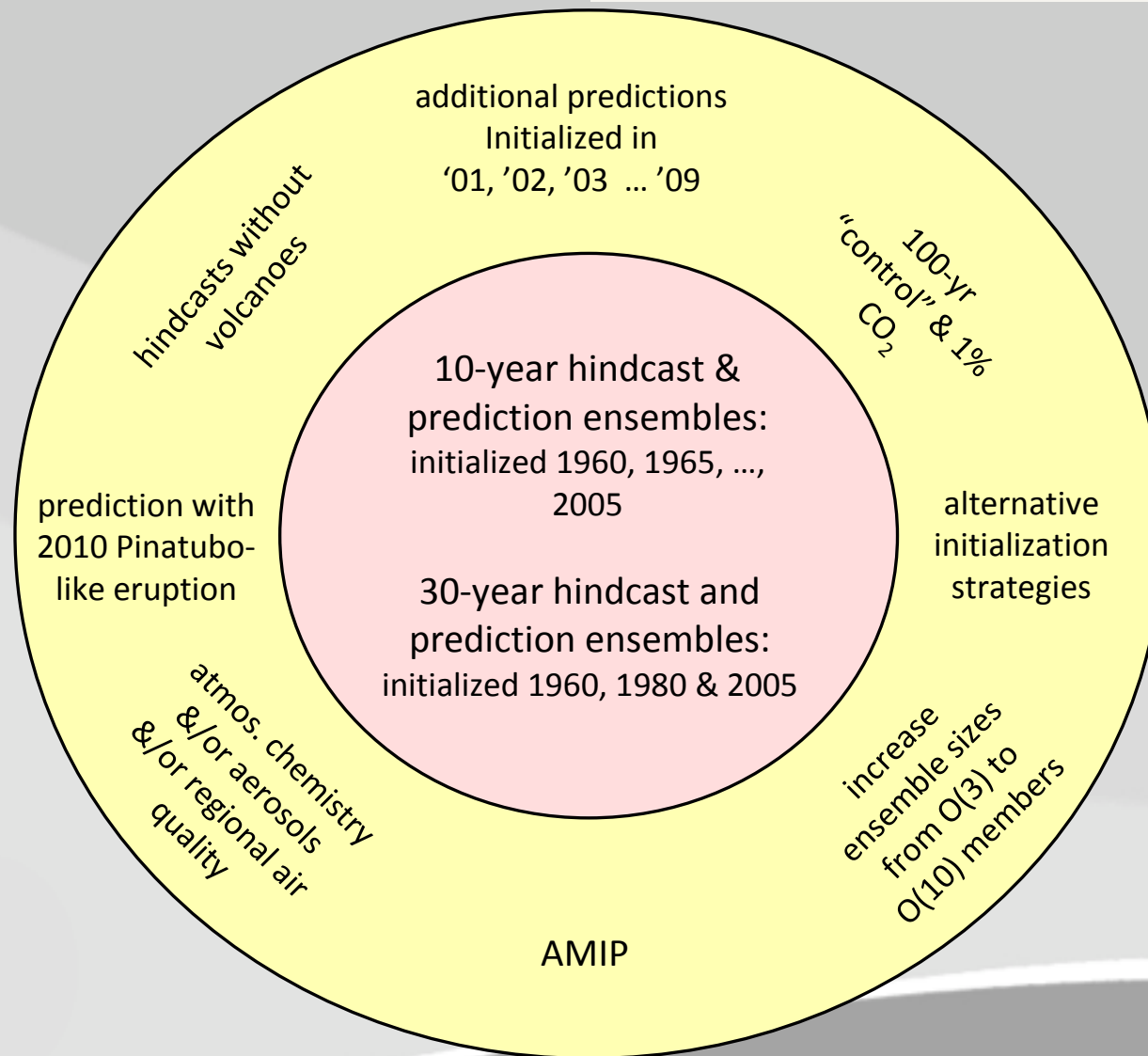




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CMIP5 “Decadal Prediction” experiments



Core: 480 yrs
Tier 1: ≥1700 yrs

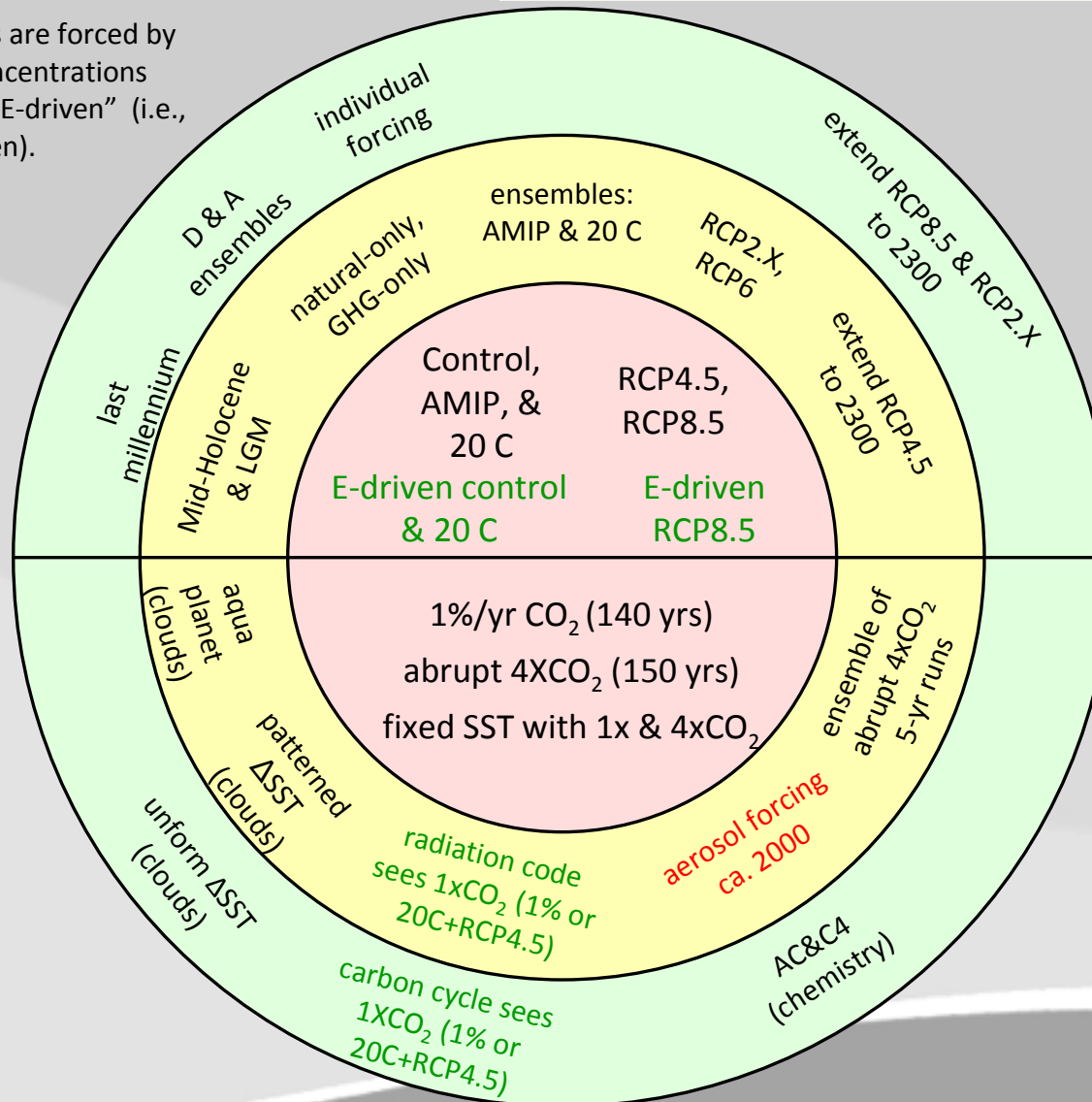


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CMIP5 “Long-term” experiments

All simulations are forced by prescribed concentrations except those “E-driven” (i.e., emission-driven).



Core: ≥1718 yrs
Tier 1: ≥1727 yrs
Tier 2: ≥2038 yrs

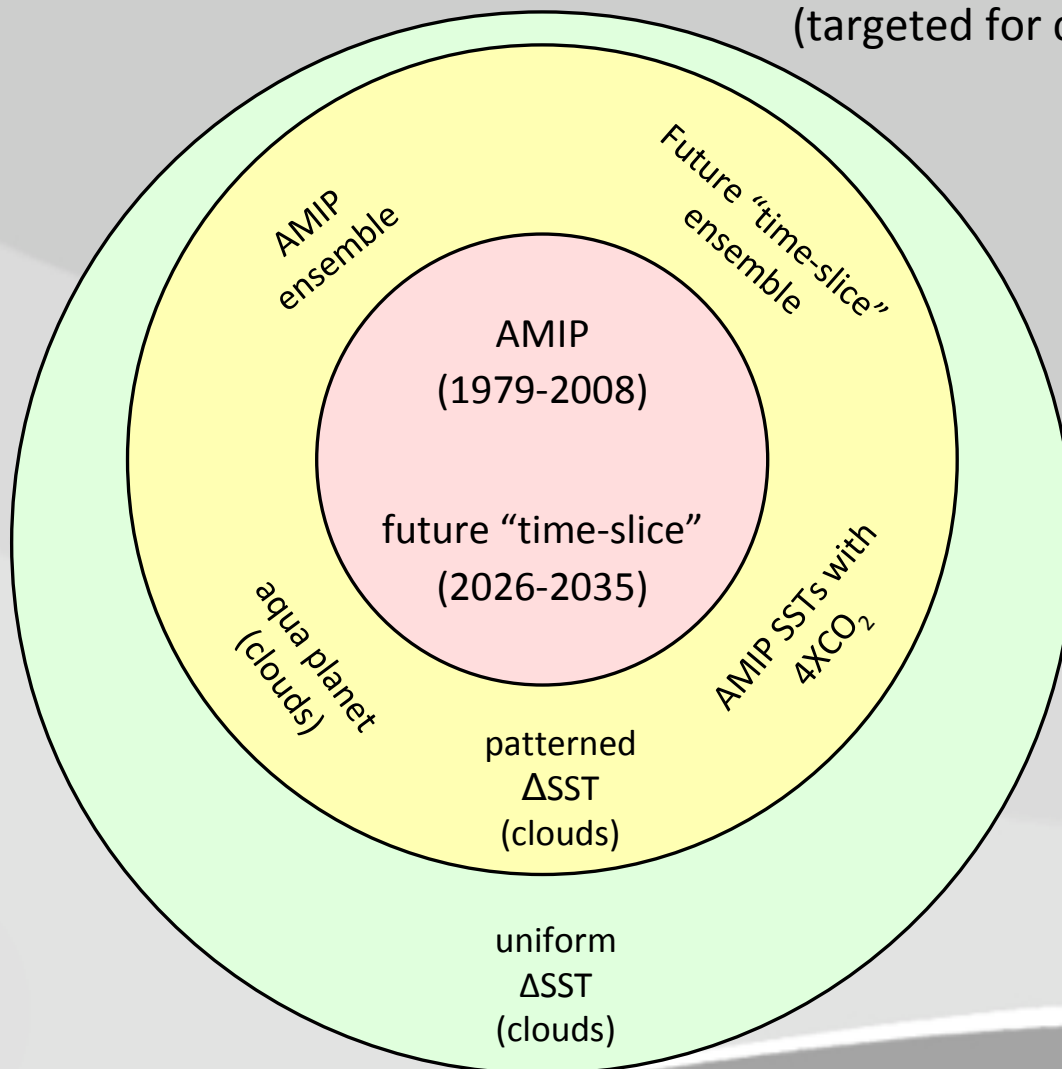


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CMIP5 “Atmosphere-Only” experiments

(targeted for computationally demanding and NWP models)



Core:	40 yrs
Tier 1:	≥185 yrs
Tier 2:	30 yrs

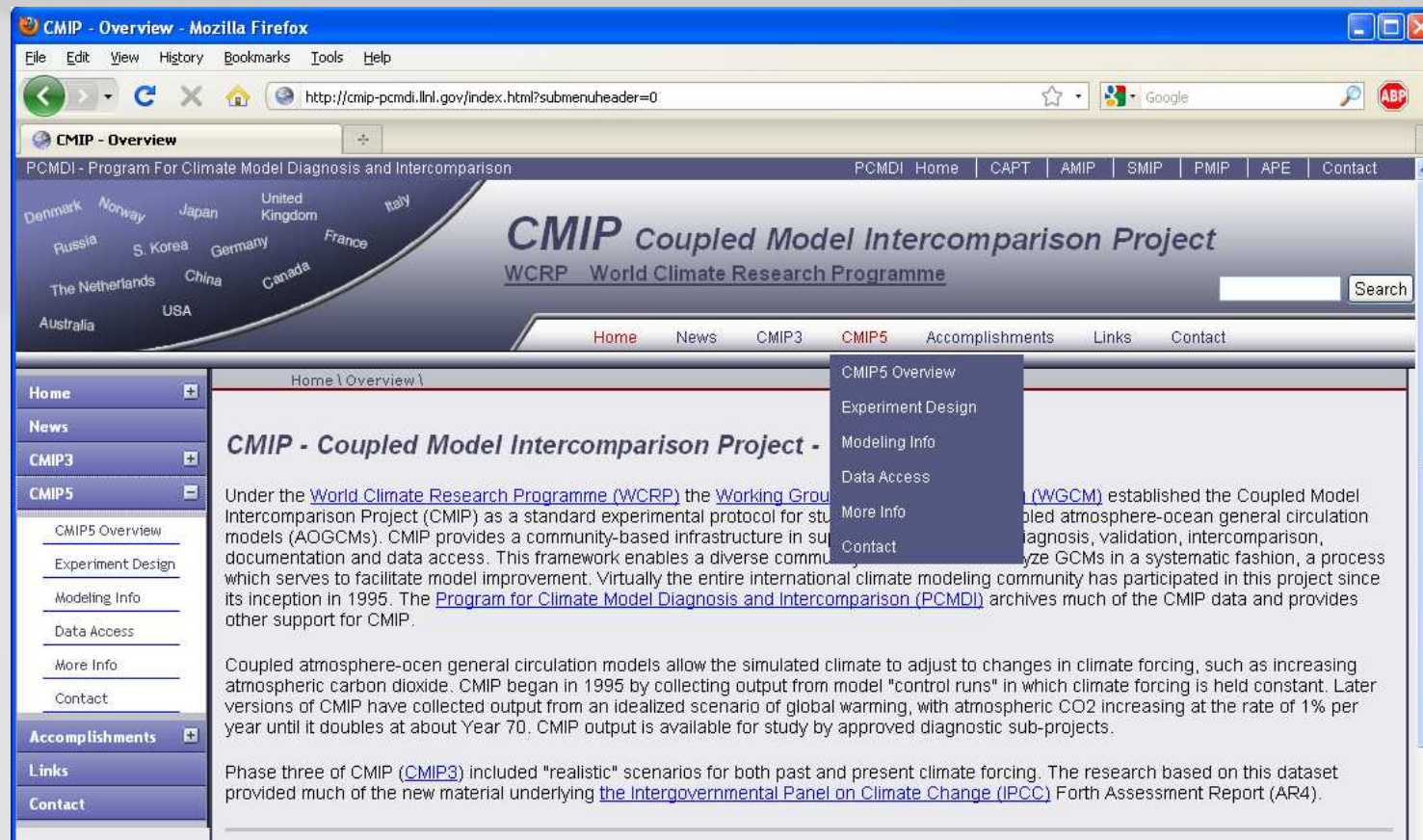


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CMIP5 website now in place

- <http://cmip-pcmdi.llnl.gov> (created by Dr. Renata McCoy)
- Essential information in place, but more to come





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CMIP5 “Modeling Info” page

CMIP5 - Modeling Info - Forcing Data - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://cmip-pcmdi.llnl.gov/cmip5/forcing.html?submenuheader=2

CMIP5 - Modeling Info - Forcing Data

PCMDI - Program For Climate Model Diagnosis and Intercomparison

PCMDI Home CAPT AMIP SMIP PMIP APE Contact

Denmark Norway Japan United Kingdom Italy
Russia S. Korea Germany France
The Netherlands China Canada
Australia USA

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Search

Home News Experiment Design Modeling Info Data Access More Info Contact

CMIP Home \ CMIP5 Home \ Modeling Info \ Forcing Data \

CMIP5 - Modeling Info - Forcing Data

The following forcing data is available:

1. [Recommended CMIP5 solar forcing data.](#)
2. [The Representative Concentration Pathways \(RCP\) emissions scenario database.](#)
3. [Gridded historical and RCP emissions scenario database.](#) New 08/31/2009.
4. [Land-use data.](#) New 08/31/2009.
5. [The AC&C/SPARC ozone database.](#) New data 09/24/2009.
6. [The RPC white paper - past 2100 scenarios - from IAM group.](#)
7. [The AMIP Sea Surface Temperature and Sea Ice datasets.](#)
8. [Specifications for CFMIP-inspired experiments.](#)

1. Recommended CMIP5 solar forcing data.

See SOLARIS website
http://www.geo.fu-berlin.de/en/met/ag/strat/forschung/SOLARIS/input_data/CMIP5_solar_irradiance.html
for information and to download the solar irradiance.

2. The Representative Concentration Pathways (RCP) emissions scenario database.

The letter from Keywan Riahi, May 2009:

This is to let you know that we've yesterday opened the database for the public and removed the password. Presently the data of two of the

Getting Started
Terms of use
Citation
Availability
Data Portal
Documents
FAQs



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List of CMIP5 output fields

- http://cmip-pcmdi.llnl.gov/cmip5/data_description.html
- 95% complete; 99% correct
- Some last minute changes not yet in tables
- Some CF “Standard Names” not yet decided



Model output requirements and CMOR2

- CMOR2 released (and has been fairly thoroughly tested)
- CMOR2 writes data in compliance with CMIP5 requirements
- CMOR2 can be accessed from C, FORTRAN, and Python Codes
- CMOR “input tables” not yet available (awaiting completion of standard output tables)
- Changes in output requirements relative to CMIP3
 - Output may be on native grid, rather than longitude-latitude cartesian
 - New requirements for “station data” (for CFMIP runs)
 - New requirements for “climatological” data
 - New requirements for filenames and directory structures
 - Additional global attributes: modeling_realm, tracking_it, model_id, creation_date, forcing, initialiation_method, and physics_version



CMIP5 model and simulation documentation

Three steps are involved:

- Develop a **standardized vocabulary** for describing models and model simulations
- Develop an interactive web-based **questionnaire** that makes it easy for modeling groups to provide the model and simulation documentation
- Place the **information in a searchable database** linked to the model output



Collaborative and interacting groups

- Metafor — a primarily European consortium led by Eric Guilyardi
 - Developing the schema and controlled vocabulary that will be used.
 - Received exclusive endorsement from the CMIP panel to gather documentation.
 - putting together the questionnaire
- Earth System Curator — a primarily U.S. team led by V. Balaji and Cecelia DeLuca
 - Providing tools for ingesting the information in the questionnaire.
 - Designing web-based “discovery” tools for interrogating the documentation.
 - Integrating these tools into the ESG framework.



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Questionnaire screenshot: summary page

Centers can describe
Input files and
references.

Home:NCAS HadBNL Simulations Files References Help About

Summary: UK National Centre for Atmospheric Science

Introduction
Each CMIP5 modelling centre is running *Simulations* which run *Models* on *Platforms*.
The *Models* are made up of *Components*
The *Simulations* conform to the *NumericalRequirements* of *Experiments* via what we call *Conformances* which consist of either specific code modifications or the use of specific boundary or initial condition *Files*.
The purpose of this questionnaire is to glean information about the entities denoted *thus* and/or their relationships.
We expect to see each centre enter at least one model, one platform, and then multiple simulations, each of which will involve entering descriptions of how they conform to the numerical requirements via conformances. It is not possible to start entering simulation information until at least one model and one platform have been created.

Models associated with NCAS

Model	Status
HadBNL	placeholder

Note that it can take some time to create a new model from the CMIP5 template ... be patient!

The status column provides an indicator of how much of the model description has been completed.

Computing platforms associated with NCAS

Platform	Status
Hector	

Simulations associated with NCAS

Other

Number of dataobjects and conformances listed here

Every
simulation
in the CMIP5
archive needs to
be described.

Courtesy of
B. Lawrence and V. Balaji



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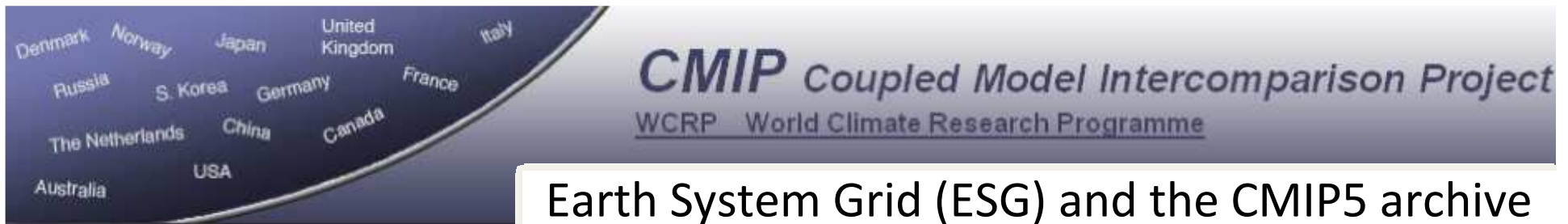
Defined vocabulary for identifying CMIP5 output

- This is called the CMIP5 “**Data Reference Syntax**” (**DRS**)
GO-ESSP, BADC, NOAA, PCMDI: Taylor, Balaji, Hankin, Juckes, Lawrence
- Specifies vocabulary for identifying models, simulations and the model output itself.
- This will facilitate data discovery and automated processing of CMIP5 output.
- For example, it will make the following filename understandable and unambiguous:

tas_Amon_HadCM3_historical_r1_185001-200512.nc

- For more information, see:

http://cmip-pcmdi.llnl.gov/cmip5/docs/cmip5_data_reference_syntax_v0-20_clean.pdf



Earth System Grid (ESG) and the CMIP5 archive

- ESG has been developed by multiple partners (ANL, LANL, LBNL, LLNL, NCAR, PMEL, ORNL, USC/ISI, and is being deployed and tested now. The software needed by modeling centers to serve their data should be ready for deployment beginning of 2010.
- CMIP5 model output will be served either by:
 - “Publishing” it on a “node” of the ESG, or
 - Sending it via multi-Tbyte disks (or via the web) to PCMDI (or in Europe, to the BADC or WDCC)
- The ESG comprises:
 - A few “Gateway” portals, which keep track of all the data on the ESG and serve as the interface to the end-users
 - Multiple “Data Nodes” where the data resides and which “publish” the data to the ESG “Gateway”.
- PCMDI, BADC, WDCC, and possibly the other gateways will “mirror” a core subset of data harvested from the Data Nodes (or via multi-TB disks)
- Data can be explored via a web interface and can be downloaded via wget, GridFTP, DML, or other alternatives.



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CMIP5 participation groups (21+)

Primary Group	Country	Primary Contact
NERSC	Norway	M. Bentsen, H. Drange
Hadley Centre	U.K.	M. Collins, C. Jones
GFDL	U.S.A.	T. Delworth, I. Held, L. Horowitz, R. Stouffer
IPSL & LMD	France	J-L. Dufresne, S. Bony
NIES & U. Tokyo,	Japan	S. Emori, M. Kawamiya, M. Kimoto,
CCCMA	Canada	G. Flato
MPI	Germany	M. Giorgetta
INGV	Italy	S. Gualdi
EC-Earth consortium	Europe	W. Hazeleger
CSIRO & BMRC	Australia	T. Hirst, K. Puri
NASA GSFC	U.S.A.	M. Suarez

Primary Group	Country	Primary Contact
CSIRO & QCCCE	Australia	L. Rotstayn, J. Syktus, S. Jeffrey
NCAR	U.S.A.	J. Hurrell, J. Meehl
MRI	Japan	M. Kimoto
METRI (with Hadley Centre)	Korea	W-T. Kwon
LASG IAP	China	T. Zhou, B. Wang
NASA GISS	U.S.A.	G. Schmidt
BCC	China	Q. Li, Y. You, Z. Wang, T. Wu, Y. Xu,
INM	Russia	E. Volodin
CERFACS & CNRM	France	L. Terray, D. Salas-Melia
U. Reading	U.K.	L. Shaffrey



CMIP3 and CMIP5 model output terms of use

- Poll of modeling groups (13 responses)
 - Red indicates number of modeling centers who object to the stated use
 - a. current "terms of use" CMIP3 output -- CMIP3: 0, CMIP5: 0
 - b. educational purposes (at public & private schools) – CMIP3: 1, CMIP5: 2
 - c. web postings based on analysis of CMIP output – CMIP3: 3, CMIP5: 3.5
 - d. for educational/entertainment – CMIP3: 3, CMIP5 3.5
 - e. mirroring the data outside the WGCM-authorized CMIP archive, but with same terms of use — CMIP3: 3, CMIP5: 2
 - f. sharing data with others without their explicit agreement to the "Terms of Use" – CMIP3: 2, CMIP5: 4
 - g. Adding "value" to the data and making this derived product available for use by others under the same "Terms of Use" – CMIP3: 2, CMIP5 2
- No restriction: CMIP3: 8 out of 12, CMIP5: 7 out of 12.

CMIP3 and CMIP5 model output terms of use

- CMIP data could be divided into two classes: **unrestricted and restricted-use**.
- PCMDI will require agreement to the “terms of use” as part of the registration procedure.
- PCMDI does not accept responsibility for enforcement of the “terms of use”
 - PCMDI could rescind access privileges to the archive, but there would be nothing to prevent the offenders from re-registering.
 - Legal proceedings against any offenders would be the responsibility of individual modeling centers.



Conclusion: CMIP5 timeline

- Presumably, groups are now ready to begin their CMIP5 simulations.
- Runs done by Summer 2010
 - Analysis will begin
 - No firm sunset date for data to be made public
- Model output available to public – Dec 2010
 - Between 1 and 2 AR5 WG1 meetings
- Journal articles accepted – May 2011
 - 2nd AR5 WG1 meeting
- IPCC AR5 published – spring 2013